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ABSTRACT

An interactive videodisc program at the California School for the Deaf, Riverside, has been used to motivate language and reading experiences and increase communication skills. Improvement in hardware and software design over the course of the project period is noted and described. An authoring system has been developed which allows teaching language tasks using nine different types of questions, including sequencing, grammar, completion, and categorization. The school's new lab consists of 11 interactive systems with an extensive library of videodiscs in science and space, literature, entertainment, math, history, and other subjects. (CL)

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An Interactive Videodisc-Computer Language Program

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Teachers have long faced the problem of locating motivating materials to teach language to hearing impaired students. The California School for the Deaf, Riverside has spent five years pioneering an interactive videodisc program to assist teachers in this area.

The project developed a system using the Apple II microcomputer system to superimpose language tasks upon video images displayed by a Pioneer laserdisc player. A sophisticated authoring program and interface card was developed for use with the two 27 minute videodiscs produced at the school by the project's instructional designers.

Two hundred language units were prepared for the field test. The equipment and software was improved and updated. The school opened one of the country's first complete interactive videodisc "labs", with eight systems to serve students from every academic department.

The California School for the Deaf, Riverside has served as one of the models of practical application of Interactive Videodisc technology for the past six years. Preparations have been made for the opening of one of the country's first fully equipped Interactive Videodisc labs during the fall of 1986. The lab will consist of eleven complete interactive systems and an extensive library of staff developed software capable of servicing entire classes of hearing impaired students from every academic department in the school.

History

The project was initiated under the direction of Robert K. Lennan, Superintendent of the California School for the Deaf.

Riverside (CSDR) in 1979. Using ESEA Title IV-C funds the project's instructional designers, Barbara A. Peterson and Rod J. Brawley, worked with Gary Galbraith, Ph.D., professor in the Department of Psychiatry and Biobehavioral Sciences, University of California at Los Angeles, to develop the initial videodisc hardware and its accompanying authoring software.

The initial goal of the project was to develop an interface card which would allow a personal computer to control all of the functions of a laser videodisc player. The computer, an Apple II series in this case, would be able to locate and show any of the 54,000 frames of information located on a videodisc. The computer would then superimpose language tasks over the visuals and the student would respond to the questions using a light pen.

One of the major concerns in designing the interface card was this ability to superimpose the questions directly over the visuals on the monitor. The designers felt that this was especially important when working with the hearing impaired. At that time, there were no affordable interface cards on the market which would accomplish this. There were, however, several which would allow the student to toggle back and forth from visual to question frames. It was felt that this process would not be acceptable for our needs. After several years of work, the interface card was developed along with a sophisticated authoring program. An authoring program is one which allows a teacher, with little or no experience with computer programming, to compose teaching tasks and lessons for the students.

A detailed description of the original videodisc project, hardware and software development, needs assessment, videodisc production, evaluation design and analysis can be found in an article

written by Peterson and Brawley in the September 1983 issue of the American Annals of the Deaf. The remainder of this paper will deal with improvements which have been made in the hardware and software and show how this technology has been used to create a "state-of-the-art" interactive videodisc language lab serving both the students and staff of the school.

Goals

The project goals have remained the same since its inception. The primary goal is to "provide hearing impaired students with increased exposure to motivating language and reading experiences in an interactive visual medium, which employs computer technology to increase communication skills that more closely approximate the skills of these students' hearing counterparts."

"The secondary goals are to train teachers of hearing impaired students to use and adapt the project's language development software to better meet their educational goals and to provide adequate inservice training on the interactive videodisc system to show the staff the potential educational impact of this new technology."

Additional goals are "to improve students' skill and understanding of the language structures evaluated by the Test of Syntactical Abilities language evaluation: improve students' vocabulary skills: and to improve students' skills in sequencing events, recognizing correctness in grammar, recognizing correctness in syntax, question response, categorization, spelling, capitalization, punctuation and sentence construction."

Also goals have been established for the staff to "increase understanding of language structures evaluated by the Test of Syntactical Abilities, develop skills in using videodisc software to create

tasks which complement the CSDR language arts curriculum, and interpret student videodisc lab performance and translate the information into meaningful classroom instruction follow up."

Hardware Requirements

The original interactive video system consisted of an Apple II Plus 48K microcomputer system interfaced to a Pioneer VP 1000 optical videodisc player. The computer would show the student a frame or series of visuals and then superimpose a language question over the picture. The student would then read the question and choose the correct response using a light pen.

During the past two years many technological improvements have been made in both the hardware and software. The current system consists of an Apple IIe microcomputer system with dual disk drives and a Pioneer LDV 4000 laserdisc player. An entirely new interface card and cords were developed for this setup. There were several reasons for these equipment changes. The Apple IIe computer is faster and has more memory that the II+ system. It also does not require the additional modification for upper and lower case letters that the II+ needed to function in the interactive system.

The Pioneer LDV 4000 is a much more compact and efficient videodisc player. It can access individual frames in a fraction of the time that the VP 1000 could.

The interface card was where most of the technological improvements were made. The original card, because it was somewhat developmental, contained a great deal of hand wiring and was found to be prone to mechanical breakdowns. The new interface card is more of a solid state design that we hope will prove to be more dependable.

The new model also allows much more accurate control of the videodisc player by the computer. It is much more exact at locating and showing individual or sequential frames from the videodisc. The prototype system was sometimes not accurate at stopping at the correct "ending frame". The new interface allows for exact location of all beginning and ending frames and any videodisc.

The most significant change in the updated hardware is the addition of a Corvus networking system. Up to this point all of the teacher made lessons have been stored on "floppy disks." Each lesson occupied a single disk. The student would "boot" up the disk and go through the program. The biggest complaint from the students during the field test program was that the system was too "slow." One reason for this was that the computer had to "access" the disk drive for each question on the lesson. Since the "access" time for a Corvus is almost instantaneous, the updated systems will be much faster. A Corvus can also store hundreds of disks of information. During the first year of the lab, about 200 units were authored. This presented a problem. Since each interactive system requires its own set of lessons, the disk management problem was becoming difficult. Eight systems with 200 units each would require 1600 floppy disks! Utilizing a Corvus system would alleviate the need for all of these disks, thus providing for a much more efficient system.

Responses to the questions can still be made using a light pen. The Gibson light pen has been incorporated into the modified system. We have found this pen to be more dependable than the one used with its predecessor. Another improvement is that the students are given the choice of using either the light pen or the keyboard to make

their responses. This was not possible with the previous system. This allows us to be less dependent on the operation of the light pen and also lets students who do not have the fine motor coordination to operate a light pen apparatus use the system.

In addition, an "accelerator card" has been added to the computer to help further with the problem of "sluggishness."

Finally, each system is connected to either an Epson or Imagewriter II printer. Upon completion of every lesson, a printout of the student's average score and a percent score for each question attempted is given. This information is kept in the lab to be shared with the teacher.

Software

The real backbone of an interactive system is its software. The authoring software is that which gives the computer the ability to control the videodisc player and provides teachers with the framework to create lessons for their students. There are many authoring programs on the market today. These were studied and found to be very limited in their capabilities. Most allow only for simple true/false, multiple choice or fill in the blank types of questions. In order to make the system capable of teaching language efficiently, a much more sophisticated program was needed.

After years of work an authoring program has been developed which allows the teaching of language tasks using nine different types of questions. They consist of the following:

1. Forced Attention - The student is shown a visual and a "caption" or explanation appears on the screen. The student merely reads this and proceeds to the next step.

2. Sequencing - The student is shown three separate visuals and then must select which action came first, second, and third.
3. Grammar - The student is shown three sentences, one of which is grammatically correct. The student must select the correct sentence.
4. Completion - The student is shown a sentence with a word or phrase missing. The student must select the correct fragment from three which are given.
5. Syntax A - The student is shown three sentences, only one of which is syntactically correct. He must choose the correct one.

   Syntax B - The student is shown parts of three different sentences. He must choose one and then make a sentence with a correct completion.

   Syntax C - The student is given all of the words of the sentence he chose in part "B", but they are mixed up. He must put them in order to make a syntactically correct sentence.
6. Question - This is a simple multiple choice task. The student is given a word, question or sentence with three choices and must choose the correct one.
7. Categorization - The student is given two categories and eight selections to match. These can be words, phrases or sentences.
8. Spelling - The student is shown a sentence with one word missing. The student uses the keyboard to type in the correct spelling of that word.

9. Punctuation and Capitalization - The student is shown a sentence with no punctuation or capitalization. The computer goes to each word and asks if a capital letter is needed. It then goes to each "space" and asks if any punctuation is needed.

When the student works on a lesson, he sees a visual stimulus and then reads the questions on the screen. He makes his responses using either a light pen or the keyboard. If the response is correct, the program automatically proceeds to the next question or task. If the response is incorrect, the student either repeats the visual and question, or is "branched" into a series of "intervention" steps which will help him in making the correct choice. The branching gives the student an example of correct usage for the task and then repeats the question. Again the computer mixes up the responses each time the questions are presented. It is this branching and intervention phase that makes the interactive videodisc such an exciting technology. The student is not learning rotely but is guided through the program at his own speed and his progress is dependent upon his responses to the questions. If the student understands the material, he proceeds quickly to the end. If he has trouble, the special branching steps have been included to remediate the problems.

At the completion of the lesson, the student is given a printout of his performance. This printout gives a total percentage of correct responses, as well as listing which questions were completed and how many attempts were made to complete each one.

Not only is this program versatile, it is also fairly simple to use. A teacher with only minimal inservicing can sit down and create

meaningful lessons in a relatively short time. The "lesson" consists of a series of questions. The authoring program is menu driven and the teacher merely decides the number and types of questions that will be used. The lesson may be as long or short as necessary. The questions can be any combination of the nine types previously described.

First, the type of task is chosen. The computer then asks for the question or sentence and the correct and incorrect responses. Next, the frame number of the visual is typed in. (Since the disc can have as many as 54,000 frames to choose from, this is often the most difficult part of authoring!) The visual can either be a still frame picture or an action segment. If it is an action segment, the computer needs to know the beginning and ending frame numbers. When all of the questions have been saved on the disk the author can "review" the tasks: "renumber" the questions: "delete" and change any questions which are not satisfactory. When finished, a printout is made for a hard copy and the lesson has been saved on a floppy disk.

Since the author is free to use any questions and compose those questions in whatever way desired, you can see the versatility of this program. A simple vocabulary matching lesson can be prepared for young or lower functioning students: or complex grammatical tasks can be prepared for older or more advanced ones. The possibilities are seemingly endless.

The Lab

The lab consists of eleven interactive systems. The eight updated units are connected to the Corvus and are being used for language and reading instruction. The three prototype systems are "stand

alone" and will be used in the future with a commercial authoring system for the teaching of science concepts.

During the last year, approximately 200 language lessons were created using the authoring program. These units were all based on the Test of Syntactic Abilities (TSA). This test was developed by Stephen Quigley to diagnose which aspects of English language structure have been mastered by hearing impaired students. The TSA consists of a screening test and sub-tests which assess the following structures: negation, conjunction, complementation, relativization, question formation, verb processes, pronominalization, determiners, and nominalization.

The screening test is available in both paper and computer software formats and is administered to each student before enrollment into the lab. The results of this test are recorded in the student's file so both the lab and classroom teachers can select appropriate units for lab work.

The language units have been placed onto the Corvus and are broken down even further into the following categories: negation, conjunction, disjunction, alternation, determiners, question formation, answer environments, "wh" questions, yes/no questions, verb processes, verb sequence in conjoined structures, main verbs, linking verbs and auxiliaries, the passive voice, pronominalization, forward and backward pronominalization, reflexives, possessive pronouns, relativization (comprehension), relative pronouns, relative adverbs, embedding, complementation, infinitives, gerunds, "that" complements and nominalization. There is also a "miscellaneous" category for units which do not fall into any of the previous mentioned areas.

As you can see, the teacher has a great deal of material from which to choose. If lessons are needed which have not been previously developed, one of two things can be done. The teacher can come into the lab and prepare his or her own units. We are hoping for that at least 25% of our staff will be willing to prepare their own lessons. Detailed inservices will be provided throughout the year for this purpose. Secondly, a teacher can request that the lab teacher prepare a special unit for their class. Special forms have been created for this purpose and require a week's notice from the teacher. Special units have been prepared for both lower and higher functioning classes. These units include things like: simple vocabulary identification, pronoun usage, adjective identification and phrases, etc. Each unit prepared is also attached to a corresponding level in the Reading Milestones series. As each unit is created, a criterion referenced test is prepared. These serve as "pre" and "post" tests to be completed by the students as they progress through the language program.

The teacher is also given much flexibility in scheduling. They are able to send students either singly (for remedial work) or as an entire class. Since the lab lends itself easily to individualization, each student can be working on a specialized lesson chosen according to his TSA test results, or they can all be working on the same lesson chosen by the teacher to correspond with work they are doing in the classroom. Frequent conferences are held between the lab and classroom teachers to decide the content of the students' lab work. This also provides for maximum teacher follow up in the classroom.

Up to now, not much has been said about what videodiscs are used in connection with the software. The initial project produced two 27 minute videodiscs. These are titled, "Discoveries With Dusty Parts I and II". The contents of these discs were the experiences of an old miner named Dusty and his friend, Rocky. They perform using sign language and visit various places around the city. They visited places and performed activities that a typical person might come into contact with during his daily life. The pre-production scripting was done to give a maximum of visuals that would lend themselves for the teaching of the language concepts from the TSA. Since the discs contain only visuals and no built in questions, a great deal of flexibility is maintained. These same discs can be used for any level of student, since the degree of difficulty is determined by the accompanying software and not the disc itself.

The majority of lessons to date have been prepared using the two "Dusty" videodiscs. Units are now being prepared which "re-purpose" other videodisc materials. Re-purposing means using other discs for their visuals and adapting them to suit your lessons. Since the computer doesn't care what videodisc it is using, we are now using discs such as "The Adventures of Donald Duck" to teach prepositions and color and pronoun identification. Imagine how motivated a student would be to learn about verb tense using visuals from "Star Wars" or "Raiders of the Lost Ark!"

The lab built up an extensive library of videodiscs in the following areas: science and space, literature, entertainment, math, history and others. We have even used a disc from a popular arcade game, "Dragon Lair".

As with any lab, a great deal of time is spent keeping the lines of communication open. Numerous inservices are given to the staff as well as outside agencies. Topics for these inservices are: the hardware, the software, the TSA, the units available, authoring for interactivity, re-purposing the videodiscs, and following up the classroom.

Detailed records are kept of the students' progress and reports are prepared for the teachers and parents for each term of the school year. Record keeping time is kept to a minimum by using a commercially available filing program. We have found that the "PFS" series accommodates our needs quite will and is fairly easy to use.

A monthly newsletter is prepared by the lab teacher to keep the staff up to date on all the improvements and additions of both hardware and software. An open house is held annually to increase staff awareness and involvement. The videodisc lab, like any computer lab, can often be a very threatening place for teachers who are unfamiliar with technology. This feeling has been kept to a minimum by maintaining an informal and open atmosphere in the lab. The teachers are free to visit as often as desired. They are also free to be involved as much as they feel comfortable. They are able to attend whatever inservice they desire and can progress at their own speed.

The response to the lab has been extremely positive by both the staff and the students. During the first year, the lab was available to only the Elementary, Junior High School and Deaf Multi-Handicapped Units. We received 100% involvement form the Elementary School, 80% from the Junior High School, and about 20% from the DMHU. At the end of each year a lab evaluation questionnaire is completed by the staff

members who make use of the facility. One hundred percent of the teachers stated that their students had shown a noticeable improvement with their language structures and that they planned to continue using the lab with their future classes. With the larger number of machines available, the lab can now serve an even larger population. We have increased the number of DMHU students to about 50% and are in the process of opening the lab to High School language and reading classes.

In the past students were only able to attend lab once a week. The larger capacity allows classes to increase to two or more times a week now. The student response to the lab has been very encouraging, after all it is the who is the integral part of the system. It is their "interaction" with the system that creates an exciting and motivating and motivating learning tool out of what would otherwise just be a collection of expensive machinery. Most people think of interactive videodisc as the union of a computer and a videodisc player, forgetting that the third and most important ingredient is the student.

The enthusiasm which can be observed in virtually every student participating in the lab is difficult to measure, but gives validation to the entire project. A great deal of time, effort and money has been invested by numerous people. What was once just an idea was converted to a full scale research project, then a field test project, and now a reality which benefits a large number of children. We are comfortable with our feeling of pride in what we have accomplished. We have come a long way, but the work is not over by any means. Continued efforts will be needed to keep this program growing and expanding to meet the ever changing technologies and changing needs of our population.